

SOLVE-II Flight Report: Thursday 12/19/02

Flight Type: Test Flight – Subtropical jet crossing

Flight Objectives:

1. Sun run for DIAS, AATS-14, and GAMS/LAABS
2. 3rd full test of lidars and in-situ instruments under sunlit and dark conditions, 3rd overpass of TMF at 5:30 pm (local).
3. Variations of constituents along N-S track as we pass across the core of the subtropical jet.
4. Ozonesonde launches from TMF: 4:30 pm & 6:00pm (local).
5. Data from this flight should be submitted to the archive.

Flight Plan:

21:30 - Takeoff
23:30 - Sun run from 22°N 116°W to 29° 15'N 119° 30'W
01:34 – Table Mtn. Overpass 34° 23'N 117° 41'W
02:18 – Turn south
03:00 - Land

Forecast Meteorology:

Southern run:

A strong nearly-zonal subtropical jet will continue to track across the eastern Pacific region in the 25°-35° latitude range, with the speeds at 00Z along the southern track flight at FL330 ranging from 110 kts at the north end to ~40 kts at start of the sun run at the south end. At FL390 the speeds will be somewhat higher.

The aviation model forecast runs have been showing a patch of saturated and nearly saturated air in the center of the jet in a layer between approximately 30 and 35 kft.; the current southbound flight track takes the aircraft through the nose of this feature. However, the satellite water vapor imagery at ~1600 UT on the 19th suggests this band of elevated humidities may already have passed through the region. In any event, the air should be very dry and cloud-free on the FL390 sun run.

Table Mountain overflight and northern leg:

A very strong winter storm system was making landfall in California in the morning with the center of the low forecast to track across the San Francisco Bay Area. At Dryden, the morning dawned clear, but the local forecast is for increasing clouds in the afternoon and rain developing overnight. Cloud cover will be increasing at Table Mountain in the late afternoon, although the NWS is not calling for a complete overcast (with cloud base at

10kft) until around 8 PM. Currently, winds are too strong for ozonesonde launches at TMF and TMF will probably be overcast.

The northerly leg will be overflying a solid overcast from the storm system, although there shouldn't be any significant cloudiness at flight level. Expect a bumpy ride, particularly at the north end, as there will be thunderstorms embedded in the rain bands.

Flight Meteorology:

To be added.

Flight Report:

Took off at 21:31 UT. The region around Edwards was very clear, but there were heavy clouds to our north in association with the deep cut-off low that was hitting the California coastline. TMF facility has clear skies during the climb-out. Winds rapidly increase to 70 kts by 33 kft as we headed southward. NMASS reported very high concentrations of ultrafine particles as we passed over the LA basin.

FastOz reported low ozone levels (60-80 ppb) immediately south of LA at (32°N, 33 kft). Ozone increased rapidly at ~31°N to about 130 ppb, but then fell off again at about 30.5°N. Potential temperature was about 326 at the time of these variations. Winds had picked up to over 110 kts near 30°N. By 29°N, ozone had fallen to about 55 ppb.

After getting out over the Pacific, we overflowed very low clouds ~ 1.5 km tops.

At about 22:26, we entered cirrus. Very thin and patchy. At 22:40, we hit a thicker patch of cirrus (~27°N). At about the same time, ozone values fell below 30 ppb. Winds had also fallen off to about 100 kts, suggesting that we'd passed the main axis of the jet into air that had a more tropospheric character.

By the time we were at 26°N, the low level clouds had disappeared entirely, and we had clear air from the surface upward with the report of sub-visual cirrus above us at ~18-19 km.

At about 25N, low level clouds again appeared below us.

At the southern end of the track, wind speeds had fallen off to about 50-55 kts, at about the 340 K level (FL 330). Ozone had fallen below 20 ppb.

On schedule, we made a left hand tear drop turn with about a 200 ft descent. Diaper reported a single hit from the planes exhaust on this turn. We then began our ascent to 39 kft. By the time we had reached 39 kft (~ 345 K), the wind speeds had increased to 80 kts westerlies. At this southern end of the track, the tropopause was clearly at about 16 km.

The sun run began approximately on schedule, while the DC-8 adjusted its heading and altitude.

At about 25N, winds had climbed upto about 99 kts westerlies. Ozone had also significantly increased from less than 20 ppb to about 80 ppb. MTP still showed that we were below the tropopause, which was just below 16 km.

The SVC from the DIAL observations were located in a two layers, one that was somewhere close to the tropopause (23-25°N), and a second higher layer that was seen on the southward leg at 18-19 km. The cirrus flown through on the southbound leg re-appeared in the DIAL downlooking data at approximately 27°N. The upper layer was also observed by Chris Hostetler's AROTAL measurements. Curiously, the layer at 18 km had virtually no depolarization. This suggests that the air might not have been traditional SVC, but possibly the remnants of a plume from an Ecuador volcano that was first reported in mid-November.

At 27.5°N, winds had increased to 107 kts W at 348 K (196.7 hPa). By 29°N, the winds had increase to about 115-120 kts W at 350 K (196.7 hPa).

Sun run was completed at 00:44 UT. Winds remained high, and out of the west (118 kts W at 32 45'N) as we moved northward. The MTP observed tropopause exhibited more of the double structure as we continued northward. This "fold" was located approximately between 10 and 12 km. Ozone steadily increased as we moved northward, rather than the sharp spike that we saw as we flew southward.

At approximately 01:00 we contacted TMF and found that the first ozonesonde launch burst after launch, and that winds had increased to 60 kts with snow on the ground at TMF. Given the conditions and the problems associated with a launch and the non-operation of the lidars, it was decided to scrub the overpass of TMF.

By 35N, winds had fallen a bit to 98 kts W at 338 K. Ozone variations between 100 and 120 ppb in this region. The MTP double tropopause was extremely pronounced at this latitude. The DC-8 was located at the 1st tropopause while the 2nd was near 16 km. Clouds below us were peaking at about 8.8 km.

At 37N, we saw high levels of ozone (300 ppb). These measurements occurred in the middle of the tropopause fold feature that was evident in the MTP profile. We made our turn southward at about 38.2N where winds were approximately 107 kts. The MTP observed trop fold was between approximately 10 and 13 km. As we ascended to 41 kft, ozone values jumped dramatically to over 550 ppbv. They then began to fall off as we proceeded southward.

Landing at 02:43 UT. Pilots: Ed Lewis and Gordon Fullerton. Mission managers: Chris Miller and Walter Klein. Mission scientist on board: Paul A. Newman.

Status Report: Instrument – PI

DIAPER (in situ aerosols) – Anderson
Good flight.

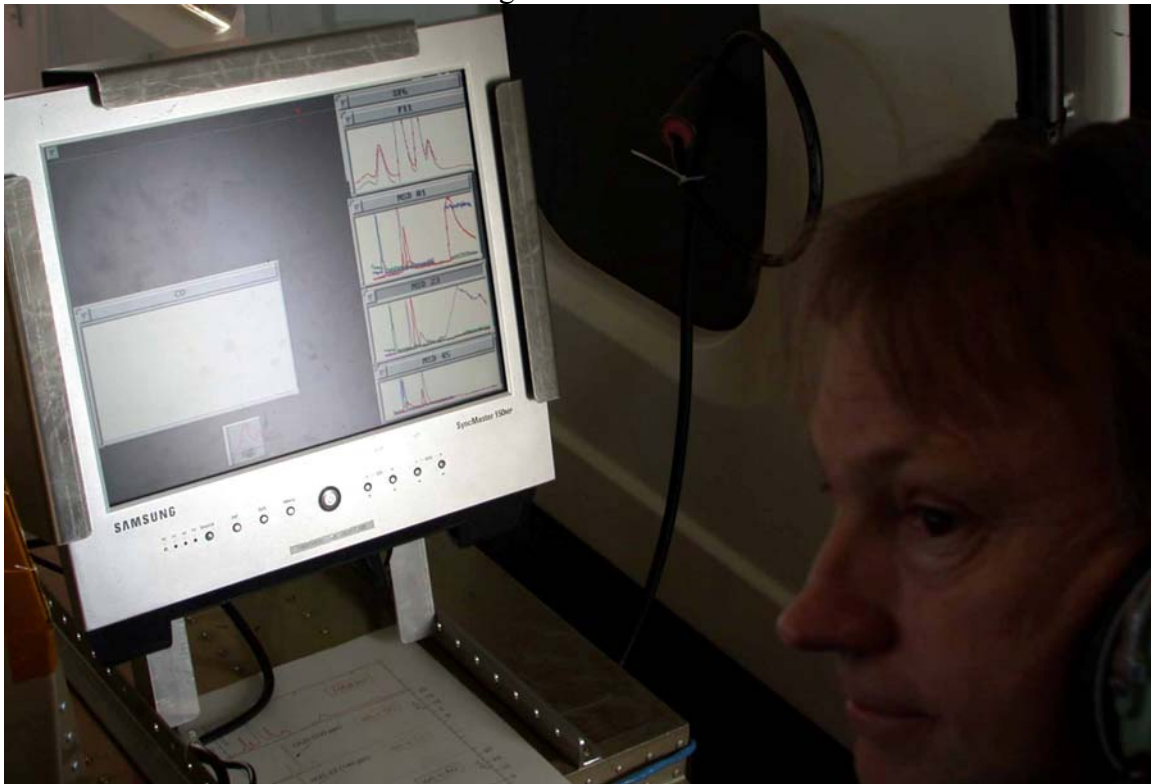
FastOz – Owens
Very good flight. Lots of good science. Instrument is working fine.

DIAL (Lidar ozone and aerosol above and below the AC) – Browell
Worked well. Very interesting data.

DACOM/DLH (in situ trace gases and open path water vapor) – Diskin
Generally had a good flight. Didn't have CO, but know the problem. DLH worked fine should be able to reduce the data.

PANTHER (in situ PAN and other trace gases) – Elkins
A pretty good flight. Mass spec ran regularly. One channel delivered good chromatography.

Fred Moore and the Panther Chromatograms.



MTP (microwave temperature profiler) – Mahoney
Good flight. A lot of interesting temperatures.

AROTAL (Lidar ozone, aerosols and temperature above the AC) - McGee/Hostetler

A good flight. Only took data when it got dark, but it looks very good.

GAMS/LAABS (solar occultation ozone, aerosols and oxygen A band) – Pitts
Perfect. Again, problems with locking on while plane maneuvered. Great spectra.

DIAS (Direct beam solar irradiance) – Shetter
Initial problems with locking onto the sun while the plane was maneuvering but good tracking thereafter. Good data.

FCAS/NMAS (in situ aerosols) – Reeves
Both instruments ran very well.

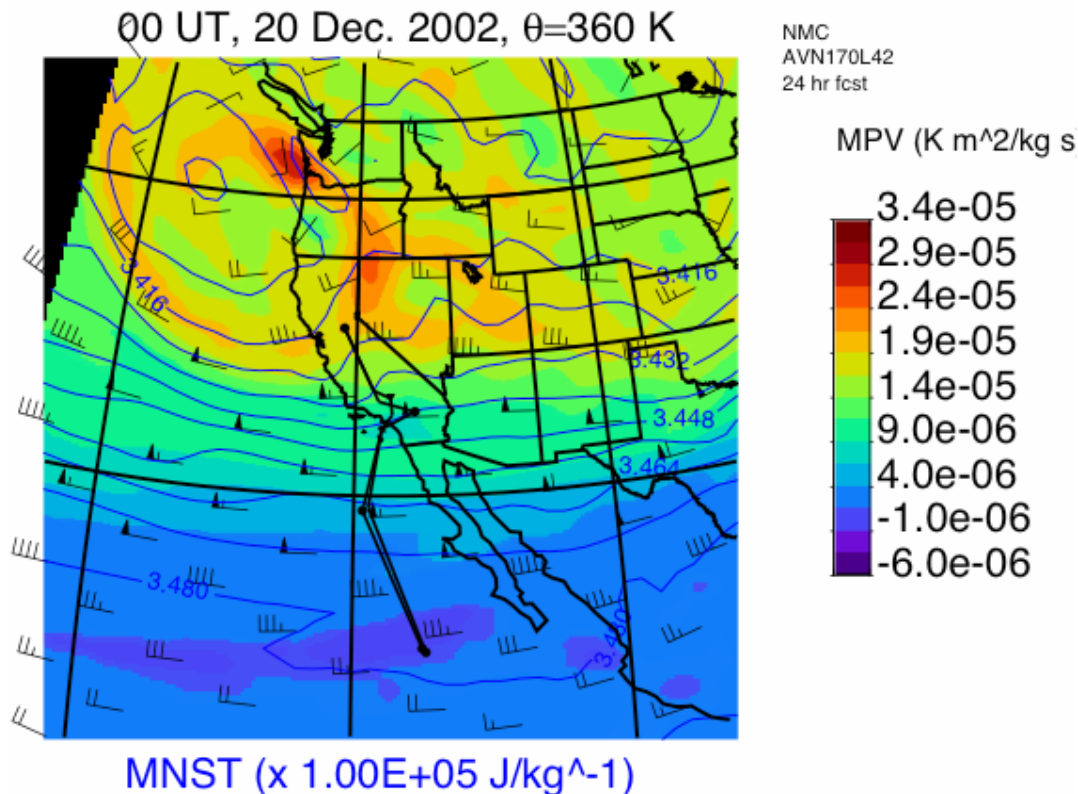
AATS-14 (sun photometer) – Russell
Perfect run. Excellent flight.

Differential GPS – Muellerschoen
Problems when phone call were being placed.

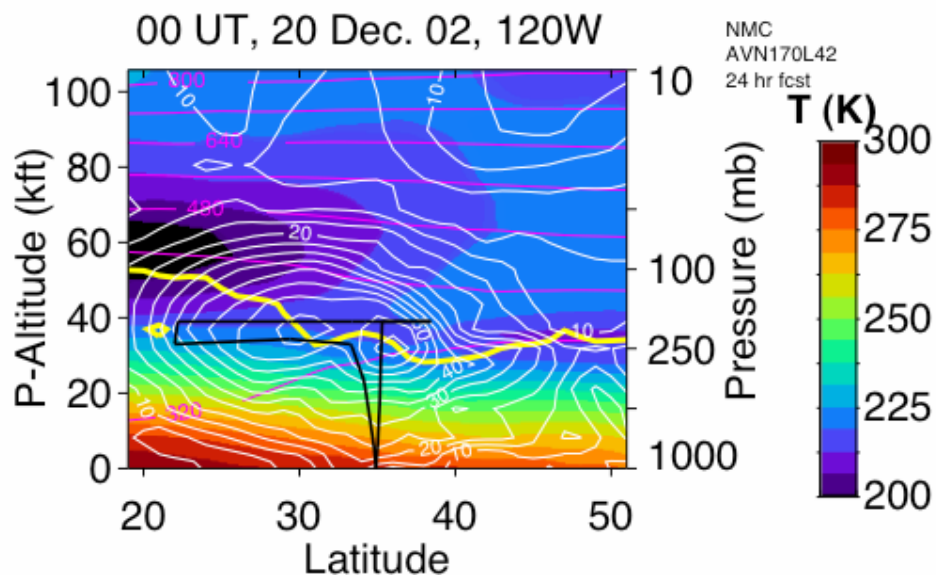
ICATS
Really good.

Plots (flight plan, solar zenith angles, Rel. humidity):

Flight Plan:



Forecast horizontal transect along 120°W 24 hr forecast.



Sunset from the DC-8 over Southern California. Note the dramatic coloring, possibly a volcanic aerosol effect. The high clouds just perceptible in the image were at about 8-9 km (part of the southern edge of the large cut-off low storm system that hit California on December 19).

